Specification

Printing Units and Method for Moving a Frame Part

The invention relates to printing units and to a method for moving a frame element, in accordance with the preamble of claim 1, 2, 25 or 30.

A printing unit is known from EP 0 749 369 B1, in which rollers are mounted in the movable frame element and rest on horizontal rails and also support the stationary frame element. In connection with a printing unit of dimensions suitable for newspaper printing, the load resting on each roller of the movable frame element can reach amounts of several tons. Thus, extreme pressures occur at the contact faces between the rollers and the rails. While the rollers can be made of hardened steel, which can be subjected to the occurring pressures, this is difficult in connection with the rails because of their dimensions. But if the rails are made on non-hardened steel the danger arises that the wheels are pressed into the rails and it becomes impossible to move the movable frame element evenly, or to put it into motion at all.

USP 5,060,569 discloses a frame element which can be moved on rollers, wherein the rails are raised for movement and the frame element rests on another frame element during operations.

DE 34 46 619 A1 describes a frame element which can be moved on rails.

For assembling a printing press it is known from the MAN Roland prospectus "5 a very useful thing ..." to move printing units by means of adjustable rollers.

The object of the invention is based on creating printing units and a method for moving a frame element.

In accordance with the invention, this object is attained by means of the characteristics of claims 1, 2, 25 or 30.

By means of the retractability of the rollers the possibility of displacing a weight resting on them at least partially to a contact surface different from the rollers is created, and of relieving the rollers in this way to the extent that the pressing of the rollers into a support need no longer be feared.

Since such a contact surface can easily be made larger than the contact surface between a roller and a support it is possible to decrease occurring pressure loads, even if the entire weight of the movable frame element is displaced to the contact surfaces different from the rollers, and the demands made on the load carrying capability of a support on which the movable frame element is supported can be reduced.

The rails on which the rollers rest in the extended state are used as supports on which the contact surfaces, which are different from the rollers, are supported.

The contact surfaces can be simply constituted by the lower edges of lateral frame plates of the movable frame element.

Preferably each frame element has at least one rubber blanket cylinder as the cylinder delimiting the printing gap, a forme cylinder and an inking system, so that the two rubber

blanket cylinders, forme cylinders, etc. each constitute a printing unit in bridge construction suitable for recto- and verso-printing.

The displaceability of the rollers between the extended and the retracted position is preferably achieved in that each of rotatable shafts of the rollers is pivotably maintained on the movable frame element. Preferably a pneumatic or hydraulic actuating member is employed for driving a pivot movement of at least one of the rollers around its eccentric axis.

If respectively two rollers, which can be pivoted around a common eccentric axis, are arranged on a common torsion-proof shaft, a single actuating member can be employed for pivoting both rollers and/or tilting of the printing unit during the retraction and extension of the rollers can be avoided.

In connection with a movable frame element with two lateral frame plates, the two rollers which can be pivoted around a common eccentric axis are respectively arranged in such a way that they support different frame plates.

Several rollers, in particular those running on a common rail or supporting the same frame plate, can be pivotably coupled by means of a rod, which acts on shafts of the rollers via levers.

In order to fix the positions of the two frame elements in relation to each other in a working position, where they are not spaced apart, a protrusion is preferably formed on one of the frame elements and is oriented in the movement direction of the movable frame element, and a cutout, shaped complementary to the protrusion, is formed on the other frame

element, which come into positive engagement with each other when the frame elements are arranged without a space between each other.

The protrusion or the cutout can automatically provide a centering effect when the frame elements are brought together if the protrusion is tapered towards its free end and/or the cutout tapers toward a bottom.

The protrusion is preferably shaped as a vertically oriented rib, and the cutout as a vertically oriented groove in order to define the position of the two frame elements relative to each other only in a horizontal direction transversely to the movement direction, but not in the vertical direction.

For guiding the movement of the movable frame element, preferably at least one upright guide rail is provided, which extends in the movement direction of the movable frame element, is fixedly connected with one of the frame elements and is enclosed on two sides by a track guidance device of the other frame element. This track guidance device preferably comprises at least one pair of guide rollers, which roll off on the sides of the guide rail.

For moving the movable frame element, a toothed rack extending in the movement direction of the movable frame element is suitably mounted on one of the frame elements, and on the other frame element a self-locking drive mechanism engaging the toothed rack, which can be disengaged from the toothed rack in order not to block the movement of the movable frame element in case of an interference. The greatly down-gearing drive mechanism is preferably realized

with the aid of a worm gear. It is preferably pivotably attached for disengagement from the toothed rack.

In order to lock stationary and movable frame elements of the printing group together in their work position, preferably at least one hook is provided on one of the frame elements, which can be brought into engagement with the other frame element and can be charged with a pulling force acting in the direction toward the one frame element. Preferably the movable frame element is identical to the above mentioned movable frame element, in addition to the frame element fixed in place on the frame, the stationary frame element can also include the support.

The hook preferably engages a roller of the other frame element, so that its movement into the engagement position and out of the engagement position is not hampered by too strong frictional forces. A pneumatic or hydraulic actuating member is preferably used for driving a pivot movement of the hook into the engagement position or out of it. The supply of the actuating member with pressure fluid is simplified if the frame element to which the hook and the actuating member are attached is the stationary frame element.

At least one hook should exert a pulling force with a downward directed component on the movable frame element in order to fix the latter in place also in the vertical direction.

Exemplary embodiments of the invention are represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, a schematic representation of a printing group with a movable frame element spaced apart from the stationary frame element,

Fig. 2, the printing group in Fig. 1 with the movable frame element in a position wherein it is not spaced apart from the stationary frame element, and with rollers extended,

Fig. 3, the printing group in Fig. 1 with retracted rollers in a work position,

Fig. 4, schematically the suspension of the rollers from a lateral frame plate of the movable frame element in the extended position,

Fig. 5, the movable frame element with the rollers in the retracted position,

Fig. 6, a perspective plan view of a running gear of the movable frame element, as well as of rails of the stationary frame element on which the running gear moves,

Fig. 7, a schematic sectional view through a wheel box of the running gear in Fig. 6,

Fig. 8, a drive mechanism for driving the movement of the movable frame element along the rails,

Fig. 9, a schematic sectional view through the drive mechanism in Fig. 8,

Fig. 10, a schematic plan view of a locking mechanism for locking the frame elements together,

Fig. 11, a partially cut view from above on the locking mechanism in Fig. 9,

Fig. 12, a schematic plan view of a locking mechanism for locking the movable frame element on the support,

Fig. 13, a schematic representation of a printing group with two movable frame elements and one fixed in place,

Fig. 14, a schematic representation of a locked printing unit in accordance with Fig. 13.

Figs. 1 to 3 illustrate the basic principle of the invention. Shown is a printing unit with four printing groups which are arranged one above the other and have pairs of cylinders 01, for example rubber blanket cylinders 01 or rollers. In a manner known per se, a plate cylinder, an inking system and a dampening system are assigned to each rubber blanket cylinder 01 and are maintained between lateral frame plates 02, 03. The interior structure of the printing groups will not be described in detail here, since it is not required for understanding the present invention, a description of this interior structure is provided in EP 0 749 369 B1, to which reference is hereby made.

The two lateral frame plates 02, together with the cylinders 01, inking and dampening systems they support, form a frame element 13, which is fixed on the frame and is solidly mounted between the upper and lower supports 04, 06. The two lateral frame plates 03, together with the cylinders 01, inking and dampening systems they support, form a movable frame element 15, they are fixedly mounted between the upper and lower supports 04, 06, which are respectively constructed on parallel rails 05 which are transversely connected with each other (see Figs. 6 and 12). The lateral frame plates 03 are provided with rollers 07 on their lower edge, which can be displaced between an extended and a retracted position, together with components maintained between them they form a movable frame element 15. Fig. 1 shows the rollers 07 in

their extended position, in which they keep the lateral frame plates 03 spaced apart from the rails 05 of the lower support 06. These rails 05 are at the same time used as a track, on which the rollers 07 roll off.

Fig. 1 shows the movable frame element 15 in a position wherein it is spaced apart from the lateral frame plates 02 and in which an operator 08 can enter the space between the pairs of rubber blanket cylinders and perform maintenance work, such as a change of rubber blankets. Following the completion of the maintenance work, the movable frame element 15 is displaced toward the left in Fig. 1 until it reaches the position represented in Fig. 2, in which the stationary lateral frame plates 02 and the movable lateral frame plates 03 touch each other at respective edges 09, 11 facing each other. In this position, still with extended rollers 07, the rubber blanket cylinders 01 of the movable lateral frame element 15 lie slightly higher than those of the stationary one. By bringing the rollers 07 into their retracted position in which they no longer protrude past the lower edge of the lateral frame plates 03, the movable frame element 15 is lowered a further distance, as represented in Fig. 3, so that the lower edges of the lateral frame plates 03 lie on the rails 05 of the support 06 and in this way the pairs of rubber blanket cylinders 01 respectively arrive at the same height and form a printing gap, in which a web 12 of material, for example a paper web 12, which is conducted between them, can be imprinted.

While in the positions in Figs. 1 and 2 the rollers 07 support the entire weight of the movable frame element 15 with the lateral frame plates 03 and the cylinders 01 of

several printing groups held between them and transfer it to a small surface of the lower support 06, in the position in Fig. 3, in which the entire lower edge of the lateral frame plates 03 rests on the lower support 05, the weight is distributed over a substantially greater area than the one in which the frame element 15 is only supported by the rollers 07. The rollers 07 support the movable frame element 15 only when it is to be moved, and possibly if, as represented in Fig. 1, it is spaced apart from the stationary frame element 13 and the space between the frame elements 13, 15 is accessible, i.e. only during comparatively short periods of time. During the printing operation the lateral frame plates 03 rest with their lower edges on the lower support 06. Thus, there is no danger that the rollers 07 press into the lower support 06, or that the rails 05 of the lower support 06 are damaged in other ways, so that the mobility of the movable frame element 15 would be hindered by this.

A preferred mechanism for retracting and extending the rollers 07 is represented in Figs. 4 and 5, wherein Fig. 4 shows the rollers 07 in the extended position, and in Fig. 5 in the retracted position. The rollers 07 have a rotatable shaft 14, which is hinged by means of a lever arm 17 on a pivot shaft 16, which is stationary in respect to the lateral frame plate 03. A lever arm 18 is rigidly connected with the lever arm 17 of the right roller 07 and its free end engages a piston rod 19 of a pneumatic or hydraulic actuating member 21, for example a hydraulic cylinder 21. One end of a rod 22, for example a synchronizing rod 22, is hinged to a free end of a lever arm 23, which is rigidly connected with the lever arm 17 of the left roller 07, and the other end is

hinged to an intermediate spot on the lever arm 18. The distance of the intermediate spot from the adjoining eccentric shaft 16, for example the pivot shaft 16, corresponds to the length of the lever arm 23, so that the lever arms 18, 23, which are coupled by means of the synchronizing rod 22, always perform the same rotating movement. In the position in Fig. 4, a chamber 26 of the hydraulic cylinder 21 facing away from the piston rod 19 has been put under pressure, so that the piston rod 19 is extended as far as a stop and maintains the rollers 07 in the extended position. The piston rod 19 is slowly retracted by means of the controlled release of pressure gas from the chamber 26 and the rollers 07 pivot in a counterclockwise direction around their pivot shafts 16 until the lower edge of the lateral frame plate 03 rests on the support 06. Then the rollers 07 are in the retracted position in which they rest loosely on the support 06, they can be lifted off the support 06 into the position represented in Fig. 5 by charging a second chamber 27 of the hydraulic cylinder 21 facing the piston rod 19.

Fig. 6 shows a detailed representation of a running gear of the movable frame element 15, as well as two rails 05 of the lower support 06 on which the running gear can be moved. The already described hydraulic cylinder 21, the piston rod 19 and the lever arm 18 can be recognized. The end of the hydraulic cylinder 21 facing away from the piston rod 19 is connected with a horizontal arm 28 extending from a flange 29, from whose side facing the viewer four pins 31 project. These pins 31 are screws 31, which are provided for screwing the flange 29 to one of the two lateral frame plates

03 of the movable frame element 15 (which are not represented in Fig. 6). Corresponding pins 32, or screws 32, used for the same purpose protrude past the lateral walls of two wheel boxes 33, 34. Each one of the wheel boxes 33, 34 contains one of the already mentioned rollers 07.

A schematic section through the wheel box 34 is represented in Fig. 7. The position of the pivot shaft 16 is indicated by a cross. It is the longitudinal axis of a shaft 36, for example a pivot shaft 36, extending transversely through the wheel box 34, at which the lever arm 18 connected with the piston rod 19 acts outside of the wheel box 34. The lever arm 17 is realized by an eccentric sleeve 37, whose interior bore encloses the pivot shaft 36 fixed against relative rotation, and whose exterior circumference supports a roller 07 by means of a bearing 38, for example a rolling bearing 38. The center of the exterior circumference of the sleeve 37, which defines the axis of rotation of the roller 07, is identified by a cross. If the lever arm 18 is rotated in a clockwise direction, the rotatable shaft 39 moves along the arrow 41, so that finally a portion of the running face of the roller 07 emerges from the open underside of the wheel box 34.

As shown in Fig. 6, the pivot shaft 36 extends, starting at the wheel box 34, transversely underneath the movable frame element 15 and crosses through a wheel box 42, on which a roller 07 is mounted in the same way as in the wheel box 34.

The synchronizing rod 22 acts on the one hand via a lever arm 43, and on the other hand via the lever arm 23, on the pivot shaft 36, as well as on a shaft 44, for example a

pivot shaft 44, which is parallel with it and passes through the wheel box 46 and 33. The movements of all rollers 07 into the extended or retracted position are coupled to each other by the synchronizing rod 22 and the continuous rigid pivot shafts 36, 44.

A guide rail 47, here with an F-shaped cross section, is rigidly connected with the two wheel boxes 33, 34. This guide rail 47, which can be displaced together with the movable frame element 15, has a vertically downward directed rib 48 which, in case of a displacement of the frame element 15, moves with contact between two pairs of guide rollers 49, which are mounted on one of the rails 05 remote from a rolling surface over which the rollers 07 move. The cooperation between the guide rail 47 and the guide rollers 49 forces an exactly linear movement of the movable frame element 15 along the rails 05, without the possibility of an offset transversely to the longitudinal direction of the rails 05. Although not represented, a corresponding guide rail 47 and guide rollers 49 can also be mounted on the wheel boxes 42, 46, or on the support 06 which, in Fig. 6, faces the viewer.

The drive mechanism represented in a perspective plan view in Fig. 8, is mounted on the running gear, or on one of the lateral frame plates 03 mounted thereon, of the movable frame element 15. Two rigid arms 51 project transversely in respect to the movement direction away from the running gear or one of the lateral frame plates 03. Between them, these arms 51 support a drive unit 53, which is hingedly suspended from a shaft 52 and has a motor 54, for example an electric motor 54, which drives a gear wheel 56 via a self-locking

reduction gear housed in the drive unit 53. In the represented position of the drive unit 53, the gear wheel 56 meshes with a stationary toothed rack 57.

Fig. 9 shows a section through the drive mechanism in Fig. 8. It can be seen that the drive unit 53 is supported by a projection 58 of a pivot lever 59 hinged on one of the arms 51, and the gear wheel 56 is maintained in engagement with the toothed rack 57 by means of this. If the pivot lever 59 were lifted, the drive unit 53 could pivot in a clockwise direction around the shaft 52 and in this way move the gear wheel 56 out of the toothed rack 57 and cancel the non-positive connection between the electric motor 54 and the toothed rack 57.

A gear wheel 61, which is directly driven by the motor 54 and meshes with a larger gear wheel 62, is located inside the drive unit 53. It is mounted on a common shaft together with a worm 63, which in turn meshes with a worm wheel 64, which is mounted on a common shaft with the gear wheel 56. The worm 63 and the worm wheel 64 cause self-locking of the gear, by means of which the gear wheel 56 is arrested when the electric motor 54 is switched off.

Fig. 10 shows a portion of one of the stationary lateral frame plates 02 and one of the movable lateral frame plates 03, whose vertical edges 09, 11 touch each other in the operating position of the printing unit, having a mechanism for locking the lateral frame plates 02, 03 with each other in the operating position. This mechanism includes a pivotable hook 66, which is hinged to a forked bearing block 67 shown in section in Fig. 10. Two bores 68 are used for screwing the bearing block 67 on the lateral

frame plate 02, these bores 68 permit horizontal play of the bearing block 67. In spite of measurement tolerances of the hook 66 and the lateral frame plates 02, 03, this play allows the exact placement of the bearing block 67 in such a way that an interior flank 69 of the hook 66 extends around a locking protrusion 71 on the movable lateral plate 03 with exact contact. The radius of the interior flank 69 in relation to the pivot shaft of the hook 66 on the bearing block 67 is slightly decreased in a counterclockwise direction, so that the interior flank 69 is capable of extending behind the locking protrusion 71, even if the edges 09, 11 of the lateral frame plates 02, 03 do not directly touch each other, and of pulling the two lateral frame plates 02, 03 against each other by pivoting the hook 66 in a clockwise direction until they touch each other in the contact position shown. The pivot movement of the hook 66 is driven by an actuating member 72, for example a pneumatic cylinder 72.

The locking protrusion 71 is constituted by a central pin 73, which is fixedly connected with the lateral frame plate 03, and a roller 74 seated in a roller bearing and surrounding the pin 73. This roller 74 can turn along when the hook 66 is pressed on the locking protrusion 71, so that, in spite of considerable tractive forces which the hook 66 can exert on the locking protrusion 71 in the course of pivoting, the movement of the hook 66 is not blocked by too much friction.

For preventing the bearing block 67 from slipping on the lateral frame plate 02, so that sufficient tractive force can no longer be exerted on the locking protrusion 71, the

bearing block 67 is additionally secured by two screws 76, which are screwed into the bearing block 67 from the direction of a retaining block 77 rigidly fastened to the plate 02. Fig. 10 shows these screws tightened until they make contact, so that the bearing block 67 touches the retaining block 77. If the screws 76 are loosened a little, it is possible to place the bearing block 76 a little closer to the edge 09 and to fix it in place on the lateral frame plate 02 with the aid of screws entering into the bores 68.

Fig. 11 shows the locking mechanism of Fig. 10 partially in a view from above and partially in section. The pneumatic cylinder 72 and the hook 66, which it hingedly engages, can be seen. Two depressions have been formed at the touching edges 09, 11 of the lateral frame plates 02, 03, wherein an insertion body 78 with a vertical cutout 79, for example a groove 79 of a trapezoidal cross section, is screwed into the depression of the lateral frame plate 02, and an insertion body 81 with a protrusion 82, for example a rib 82 which positively engages the groove 79, is housed in the recess of the lateral frame plate 03. The insertion body 81 is simultaneously used as a support for the pin 73 and the roller 74 of the locking protrusion 71.

The rib 82 and the groove 79 provide an exactly flush alignment of the lateral frame plates 02, 03 in respect to each other transversely to the movement direction when they touch each other in the operating position of the printing unit. In order to avoid redundancy, insertion bodies 81 with the groove 79 and rib 82 are only provided at one of the two lateral frame plates 02, 03 of the stationary or the movable frame elements 15, the insertion bodies attached to the

respectively other lateral frame plate 02, 03 are flat on their facing sides. The rib 82 and groove 79 permit a vertical movement of the lateral frame plates 02, 03 against each other in the course of the transition of the rollers 07 from the retracted and the extended positions.

Fig. 12 shows two hooks 83, which are respectively provided in pairs on the two lower supports 06. A first hook 83 with a ramp-shaped upper side is pivotable around a shaft 84 at the lateral frame plate 02 and has a notch 86 on its upper side which, in the locked state, receives a locking protrusion 87 of the lateral frame plate 03. The structure of the locking protrusion 87 is the same as that of the locking protrusion 71. An actuating member 88, for example a pneumatic cylinder 88, which is mounted, substantially horizontally oriented, on the lower support 06, is used for locking and unlocking the hook 83. The piston rod of the pneumatic cylinder 88 is hinged to a first rod 89, which acts on the hook 83, and to a second rod 91, whose second end is in turn hinged to the support 06 and forms an angle with the rod 89. When the piston rod is retracted from the represented extended position, the angle between the rods 89, 91 is reduced, the point of engagement of the rod 89 at the hook 83 is lowered, and the locking protrusion 87 is released, so that the movable frame member 15 can be shifted.

The same as the pneumatic cylinder 88, a second actuating member 92, for example a pneumatic cylinder 92k, is substantially horizontally oriented on the support 06 and has a piston rod which acts via two rods 93, 94, which are angled in relation to each other similarly to the rods 89, 91, on the one side on the support 06 and on the other side on a

hook 96. Like the hook 66, this hook 96 has an interior flank 97 which, in the course of extending the hook 96, slides along a locking protrusion 98 of the lateral frame plate 03 and in the process exerts a tractive force on the locking protrusion 98 directed downward and in the direction toward the lateral frame plate 02, which becomes larger the closer the hook 96 is to its contact position represented in Fig. 12. Thus, the hook 96 exerts a double locking function, for one, it keeps the lateral frame plate 03 pressed against the lateral frame plate 02, and it also maintains it fixed on the support 06.

The hooks 66, 83, 96 can be actuated by means of a toggle lever, for example.

In another exemplary embodiment (Fig. 13 and Fig. 14), the printing unit has three frame elements 104, 106, 107, each consisting of two lateral elements 102, 102, 103, which are fixedly mounted between upper and lower supports 04, 06, wherein forme cylinders and transfer cylinders are arranged in the center frame element 106, inking systems assigned to the forme cylinders are arranged in the two outer frame elements 104 and 107.

As represented in Fig. 13, the two outer frame elements 104 and 107 can be moved into a maintenance or set-up position, so that an accessible space between them is created.

The combined state as represented in Fig. 14 is the production position, i.e. the printing unit prints. In the course of this the three frame elements 104, 106, 107 are connected with each other by means of a locking device 108.

In the present example, the center frame element 106 has at least two pairs of cylinders arranged as a bridge printing group, but preferably four bridge printing groups arranged to work together vertically.

The forme cylinders of the exemplary embodiments preferably have at least two printing plates in the axial direction, preferably four printing plates.

List of Reference Numerals

01	Rubber blanket cylinder
02	Lateral frame plates
03	Lateral frame plates
04	Support, upper
05	Rail
06	Support, lower
07	Roller
08	Operator
09	Edge (02)
10	-
11	Edge (03)
12	Web of material, paper web
13	Frame element
14	Rotatable shaft
15	Frame element
16	Eccentric shaft, pivot shaft
17	Lever arm
18	Lever arm
19	Piston rod
20	-
21	Actuating member, hydraulic cylinder
22	Rod, synchronizing rod
23	Lever arm
24	Cylinder chamber
25	-
26	Chamber

27	Chamber
28	Arm
29	Flange
30	-
31	Pin, screws
32	Pin, screws
33	Wheel box
34	Wheel box
35	-
36	Shaft, pivot shaft
37	Sleeve, eccentric
38	Rolling bearing
39	Rotatable shaft
40	-
41	Arrow
42	Wheel box
43	Lever arm
44	Shaft, pivot shaft
45	-
46	Wheel box
47	Guide rail
48	Rib
49	Guide roller
50	-
51	Arm
52	Shaft
53	Drive unit
54	Motor, electric motor
55	-
56	Gear wheel

57	Toothed rack
58	Protrusion
59	Pivot lever
60	-
61	Gear wheel
62	Gear wheel
63	Worm
64	Worm wheel
65	-
66	Hook
67	Bearing block
68	Bore
69	Interior flange
70	-
71	Locking protrusion
72	Actuating member, pneumatic cylinder
73	Pin
74	Roller
75	-
76	Screw
77	Retaining block
78	Insertion body
79	Cutout, groove
80	-
81	Insertion body
82	Protrusion, rib
83	Hook
84	Shaft
85	-
86	Notch

87	Locking protrusion
88	Actuating member, pneumatic cylinder
89	Rod
90	-
91	Rod
92	Actuating member, pneumatic cylinder
93	Rod
94	Rod
95	-
96	Hook
97	Interior surface
98	Locking protrusion
99	-
100	-
101	Lateral frame plates
102	Lateral frame plates
103	Lateral frame plates
104	Frame element, outer
105	-
106	Frame element, center
107	Frame element, inner
108	Locking mechanism